ORIGINAL TRANSLATION

Flange connection between a longitudinal beam of a vehicle and a carrier element that can be mounted to it

The invention relates to a flange connection as set forth in the main subject of patent claim 1.

Such a flange connection is known from the disclosure document DE 198 54 050 A1. A threaded bolt, exhibiting nuts that rest on the inner sides of the flange plate and the counter flange plate and that are screwed onto both sides of said bolt, penetrates the flange plate and the counter flange plate. The purpose of this known threaded connection is that the connected components can be separated from one another, even if, in particular, the nut that is located in the driving direction in the front should no longer be accessible due to damage.

Other known connections of vehicle components that can be separated are embodiments that do not include flange plates. For example, patent document EP 0 721 878 B1 describes an assembly connection that exhibits connection profiles that engage in one another in a hook-like manner and with a clamping screw securing the positive fit.

It is the objective of the invention to provide a flange connection of the kind mentioned above, where the flange plate and the counter flange plate can be held tight to one another via positively engaging connection elements that can be separated from one another.

This objective is achieved with a flange connection with the features of the main subject of claim 1 through its characteristic features.

Significant for the invention is that the holding the flange plate and the counter flange plate tight to one another is accomplished using a wedge connection that includes a movable element, the locking component, which moves in one plane that is parallel to the flange plane for the purpose of tightening and loosening the flange connection. The required actuation of the clamping screw, which is tightened against the connection bolt, can be accomplished from a direction that is not the same as the longitudinal direction of the longitudinal beam of the vehicle and the carrier element that can be mounted to it, which improves the accessibility to the clamping screw even in case of damage. In addition, the movability of the flange plate and the counter flange plate to one another can be accomplished easily by making the play around the connection bolt in the feed-through opening of the counter flange plate sufficiently large and by providing for the locking component sufficient play for moving at the inner side of the counter flange plate. This provides for a tolerance balance for the vehicle components that are arranged at the carrier element through an adjustment relative to the longitudinal beam of the vehicle in the cross direction of the vehicle, the y-direction as well as in the height direction of the vehicle, the z-direction.

Advantageous design features of the invention are found in the sub claims.

Below, the invention will be described in greater detail based on a drawing of an exemplary embodiment, where

Fig. 1 is a perspective exploded view of the elements of a flange connection of the kind mentioned above,

Fig. 2 is a perspective sectional view of the flange connection according to Figure 1 in its connected position,

Fig. 3 is a longitudinal section through the flange connection prior to the flange plate and the counter flange plate being joined together,

Fig. 4 is a longitudinal section through the flange connection in its connected position

Fig. 5 is perspective view of the counter flange plate at the respective component and of the locking component in the position immediately prior to passing through the feed-through opening of the counter flange plate, and

Figs. 6 and 7 are longitudinal sections through the counter flange plate and the component according to Fig. 5 one time in a partially passed through position and the other time with the locking component having transitioned to the end position.

In detail, Fig. 1 shows a section of a vehicle component 1, which is the front end of a longitudinal beam of the vehicle. A second component 2, which is a carrier element for vehicle attachments, can be mounted onto component 1 in the extension of its longitudinal direction and which, in a preferred embodiment, constitutes a crash box. At one of these two components, here at component 1, a flange plate 3 is placed at the face side, and in the same manner, a fixed mounted counter flange plate can be found at the rear face side of the second component 2. The flange plate 3 and counter flange plate 4 can be held tight to one another for the purpose of connecting the two components 1 and 2, whereby the outer side 5 of the flange plate 3 rests on the outer side 6 of the counter flange plate 4. The connected position of the entire flange connection can be seen in Figures 2 and 4.

A connection bolt 7 that is positively connected to flange plate 3 protrudes from the outer side of flange plate 3 of component 1. It is expedient for the connection bolt 7 to be positioned centrally at the flange plate 3, and for it to be surrounded by a bead 26 that is embossed from the outer side 5 of the flange plate 3 and that allows in a very limited manner a longitudinal adjustment of the connection bolt 7 relative to the flange plate 3. Essentially, however, the connection bolt 7 is with its longitudinal direction oriented orthogonal to the plane of the flange plate 3.

Inherently, the connection bolt 7 can have any kind of cross-section, even a round cross-section. For the exemplary embodiment, the connection bolt 7 has a rectangular or square cross-section, which, among others, provides for a large-area support slope 14 that stretches across the entire bolt cross-section at the front, free end 11 of the connection bolt 7. Near the flange plate 3, a transverse groove 8 is molded into the connection bolt 7, essentially perpendicular to its longitudinal direction, and stretches, therefore, in the direction of a radial plane of the connection bolt 7. The transverse groove 8 exhibits an upper edge 10 located at the outer side of the connection bolt 7 and running along one of the straight rectangular or square sides of the bolt cross-section.

Of particular significance is the flank of the transverse groove 8 that is farther away from the flange plate 3 and forms a wedge slope 9. The wedge slope 9 slants from the upper edge 10 of the transverse groove 8 that is oriented in the direction of the free end 11 of the connection bolt 7 towards the groove root in the direction of the flange plate 3 or away from the free end 11 of the connection bolt 7. On the side of the connection bolt 7 that is located opposite the transverse groove 8, a plane support area 22 is formed due to the rectangular or square cross-section. The function of said support area will be covered later.

As Figures 2 and 4 illustrate, in the connected position of the flange connection, the connection bolt 7 at the flange plate 3 has passed through the counter flange plate 4 of the component 2. For this purpose, a feed-through opening 12 is provided in the counter flange plate 4, which can be recognized particularly well in Fig. 5. Although the feed-through opening 12 in the counter flange plate 4 has a basic shape that is adapted to the cross-sectional shape of the connection bolt 7, one can recognize, particularly in Fig. 4, however, that the width of the feed-through opening 12 is greater than would be required for the passage of the connection bolt 7, such that with the counter flange plate 4 resting on the flange plate 3, said counter flange plate can be moved in relation to the flange plate 3 in all radial directions of the connection bolt 7 by a specified play, which will not be obstructed as long as the connection bolt 7 does not strike the edge of the feed-through opening12 in the counter flange plate 4. If the flange plate 3 rests with its outer side 5 on the outer side 6 of counter flange plate 4, the transverse groove 8 at the connection bolt 7 will be located with its wedge slope 9 in front of the inner side 13 of the counter flange plate 4, whereby the wedge slope 9 will be at a distance from the inner side 13 of the counter flange plate 4, as can be seen in Fig. 4.

Securing the flange connection in the connected position is carried out via a locking element 15 that interacts with the connection bolt 7. As can be seen, particularly in Fig. 1, the locking component 15 is a ring-shaped object and in fact a closed ring in the shape of a rectangle or square, which features ring sections 16 that run in a straight direction. As can be seen in Fig. 2, in the connected position of the flange connection, the ring-shaped locking component 15 surrounds the connection bolt that protrudes through the counter

flange plate 4, which requires that the locking component 15 be brought to the inner side 13 of the counter flange plate 4. It is understood that the ring opening 31 of the locking component 15 must be sufficiently large for the connection bolt 7 to pass through.

At the straight ring section 16 of the locking component 15 that rests, in the locked position, at that side of the connection bolt 7, where its transverse groove 8 is located, a bridge 17 is formed longitudinally on the inner side, and a wedge surface 18 is formed there. The wedge surface 18 is located at that side of the bridge 17 that, in the connected position of the wedge slope 9, is facing the transverse groove 8 at the connection bolt 7; furthermore, the slope angle of the wedge surface 18 corresponds to this wedge slope 9. In the connected position, the locking component 15, which is held loosely at the inner side 13 of the counter flange plate 4, with the bridge 17 engages with the transverse groove 8 of the connection bolt 7 at the flange plate 3 in that the bridge 17 dips into the transverse groove 8, whereby the wedge surface 18 of the locking component 15 and the wedge slope 9 at the connection bolt 7 come to rest against each other. Due to the wedge effect, a force acts in axial direction of the connection bolt 7 upon the locking component 15, whereby the locking component 15 comes with its one side, the contact side 23, into solid contact with the inner side 13 of the counter flange plate 4. Conversely, due to the wedge effect, an axial tensile force acts upon the connection bolt 7, pulling the flange plate 3 against the counter flange plate 4. As Fig. 4 illustrates, the depth of the transverse groove 8 at the connection bolt 7, and thus the engagement length of its wedge slope 9, on the one hand, as well as the engagement length of the wedge surface 18 at the bridge 17 of the locking component 15, on the other hand, are dimensioned sufficiently, such that at the intended tight contact of the flange plate 3 with the counter flange plate 4, the free edge of bridge 17 of the locking component 15 does not come to rest at the root of the transverse groove 8 of the connection bolt 7.

A clamping screw 21 is provided at the locking component 15 so that in the engagement position of bridge 17 at the locking component 15 with the transverse groove 8 of the locking bolt 7 a tight contact can be provided through additional wedging. This clamping screw 21 is situated in a threaded hole 20, which is located in a console 19 at the locking component 15. The console 19 is placed at the side of the locking component that is located opposite of the bridge 17 and protrudes at the opposite side from of the contact side 23 of this ring-shaped object. As is apparent from Figures 2 and 4, in the locked position, the clamping screw 21 rests at the contact surface 22 of the connection bolt 7; thus, tightening the tension screw 21 against the connection bolt 7 will pull the locking component 15 with its bridge 17 into the transverse groove 8 at the connection bolt 7, which effects that flange plate 3 and counter flange plate 4 are held together tightly due to the wedge effect.

An adjustment of component 2 in relation to component 1 can be carried out in the direction of the flange plane, before the tensioning is so strong that the flange plate 3 and the counter flange plate 4 are

friction-interlocked. Not only can the connection bolt 7 be moved inside the feed-through opening 12 of the counter flange plate 4, but also, the locking component too is initially held loosely to the inner side 13 of the counter flange plate 4. This is facilitated by support lugs 24 that follow the side edges of the feed-through opening 12 and that are shaped from the piece of material that is released when stamping the feed-through opening 12 into the counter flange plate 4. The support lugs 24 protrude beyond the inner side 13 of the counter flange plate 4, and stretch towards it in a perpendicular direction. At their free ends, they feature angled bars that reach behind the locking component 15, which is located at the inner side 13 of the counter flange plate 4. Using these bars 25, the locking component 15 is held sufficiently loose, such that it can be moved parallel to the plane of the inner side 13 of the counter flange plate 4, as long as - as has been mentioned - the tight contact caused through the locking component 15 is not so strong that it inhibits such a movement.

In Figures 3 and 4, one can recognize just as in Fig. 1, the bead 26 that is embossed into the flange plate 3 and that surrounds the connection bolt 7. Because of this bead 26, the flange plate 3 has a mounting area 28 for the connection bolt, with the mounting area protruding beyond the inner side 30 of the flange plate 3. In addition, one can see in Figures 3 and 4 as well as in Figures 6 and 7 a feed-through opening 29 that is located at component 2 and that is provided for the attachment of the clamping screw 21. The clamping screw 21 is located in the radial direction to the connection bolt 7, as far as the connected position of the flange connection is concerned, and it ideally protrudes through the feed-through opening 29, in order to be able to actuate it from the outer side of component 2. In this manner, not only holding together but also loosening of the two components 1 and 2 from one another is possible through access from the side. This is particularly advantageous for the component 2, which is designed as a crash box, should it be deformed due to a head-on collision of the vehicle.

Figures 5 to 7 show clearly the feature that the locking component 15 can be inserted from the outer side 6 of the counter flange plate 4 through the feed-through opening 12 into the inner side of component 2, allowing component 2 to have a closed design with the exception of the feed-through opening 29. In the width direction, the feed-through opening 12 exhibits a width that is slightly greater than the outer width of the locking component 15. On the other hand, the height of the feed-through opening 12 is smaller than the overall height of the locking component 15; for this reason, in the connected position, the locking component 15 can rest on the inner side 14 of the counter flange plate 4 with its upper and lower ring sections 16. As Figures 5 and 6 show clearly, the locking component 15 is inserted in a slanted position through the feed-through opening 12 of the counter flange plate 4, and after it has entirely passed through the feed-through opening 12, is brought into an upright position. Thereafter, the locking component 15 can be moved upwards in order to bring it with its contact side 23 in contact with the inner side 13 of the counter flange plate 4. A tappet 28, where the bottom side of the locking component can be placed, is present underneath the support lugs 24.

Furthermore, the angled bridges 25 of the support lugs 24 exhibit a slope such that the distance from the inner side 13 of the counter flange plate 4 increases in the downward direction. This, for one, enables the insertion of the locking component 15 into the inner space of component 2 in the shown slanted position, and on the other hand, in the pushed upwards and upright position, the locking component 15 is held so close to the inner side 13 of the counter flange plate 4, that after the tappet 28 is placed it cannot slip off it. The tappet 28 does not obstruct the tight hold position of the locking component 15, which is moved upwards by the connection bolt 7, which passes through when the flange connection is established, due to the sliding slope on its face side.